Hot distilled water...	24 ounces
Oxalic acid.....	10 grains
Sugar.....	½ ounce

Shake well. This and other aniline inks can be perfumed by rubbing up a drop of attar of rose with the sugar before dissolving it in the hot water.

II.—A solid blue ink, or marking paste, to be used with a brush for stenciling, is made as follows: Shellac, 2 ounces; borax, 2 ounces; water, 25 ounces; gum arabic, 2 ounces; and ultramarine, sufficient. Boil the borax and shellac in some of the water till they are dissolved, and withdraw from the fire. When the solution has become cold, add the rest of the 25 ounces of water, and the ultramarine. When it is to be used with the stencil, it must be made thicker than when it is to be applied with a marking brush.

III.—In a suitable kettle mix well, stirring constantly, 50 parts of liquid logwood extract (80 per cent) with 3 parts of spirit previously mingled with 1 part of hydrochloric acid, maintaining a temperature of 68° F. Dissolve 5 parts of potassium chromate in 15 parts of boiling water; to this add 10 parts of hydrochloric acid, and pour this mixture, after raising the temperature to about 86° F., very slowly and with constant stirring into the kettle. Then heat the whole to 185° F. This mass, which has now assumed the nature of an extract, is stirred a little longer, and next 15 parts of dextrin mixed with 10 parts of fine white earth (white bole) are added. The whole is well stirred throughout. Transfer the mass from the kettle into a crusher, where it is thoroughly worked through.

PRINTING INKS.

Black printing inks owe their color to finely divided carbon made from lampblack, pine-wood, rosin oil, etc., according to the quality of the ink desired. The finest inks are made from flame-lampblack. There are, however, certain requirements made of all printing inks alike, and these are as follows: The ink must be a thick and homogeneous liquid, it must contain no solid matter but finely divided carbon, and every drop when examined microscopically must appear as a clear liquid containing black grains uniformly distributed.

The consistency of a printing ink must be such that it passes on to the printing rollers at the proper rate. It will be obvious that various consistencies are demanded according to the nature of the machine used by the printer. For a rotary machine which prints many thousands of copies an hour a much thinner ink will be necessary than that required for art printing or for slow presses. As regards color, ordinary printing ink should be a pure black. For economy's sake, however, newspaper printers often use an ink so diluted that it does not look deep black, but a grayish black, especially in large type.

The question of the time that the ink takes to dry on the paper is a very important one, especially with ink used for printing newspapers which are folded and piled at one operation. If then the ink does not dry very quickly, the whole impression smudges and "sets off" so much that it becomes illegible in places. Although it is essential to have a quick drying ink for this purpose, it is dangerous to go too far, for a too quickly drying ink would make the paper stick to the forms and tear it. A last condition which must be fulfilled by a good printing ink is that it must be easy of removal from the type, which has to be used again.

No one composition will answer every purpose and a number of different inks are required. Makers of printing inks are obliged, therefore, to work from definite recipes so as to be able to turn out exactly the same ink again and again. They make newspaper ink for rotary presses, book-printing inks, half-tone inks, art inks, etc. As the recipes have been attained only by long, laborious, and costly experiments, it is obvious that the makers are not disposed to communicate them, and the recipes that are offered and published must be looked upon with caution, as many of them are of little or no value. In the recipes given below for printing inks, the only intention is to give hints of the general composition, and the practical man will easily discover what, if any, alterations have to be made in the recipe for his special purpose.

Many different materials for this manufacture are given in recipes, so many, in fact, that it is impossible to discover what use they are in the ink. The following is a list of the articles commonly in use for the manufacture of printing ink:

Boiled linseed oil, boiled without driers.

Rosin oil from the dry distillation of rosin.

Rosin itself, especially American pine rosin.

Soap, usually rosin-soap, but occasionally ordinary soap.

Lampblack and various other pigments.

By the most time-honored method, linseed oil was very slowly heated over an open fire until it ignited. It was allowed to burn for a time and then extinguished by putting a lid on the pot. In this way a liquid was obtained of a dark brown or black color with particles of carbon, and with a consistency varying with the period of heating, being thicker, the longer the heating was continued. If necessary, the liquid was then thinned with unboiled, or only very slightly boiled, linseed oil. Lampblack in the proper quantity was added and the mixture was finally rubbed up on a stone in small quantities at a time to make it uniform.

Boiling the Linseed Oil.—This process, although it goes by the name of boiling, is not so in the proper sense of the word, but a heating having for its object an initial oxidation of the oil, so that it will dry better. Linseed oil is a type of the drying oils, those which when exposed in thin coats to the air absorb large quantities of oxygen and are thereby converted into tough, solid sheets having properties very similar to those of soft India rubber. The process goes on much faster with the aid of heat than at the ordinary temperature, and the rate at which the boiled oil will dry in the ink can be exactly regulated by heating it for a longer or shorter time. Prolonged heating gives an oil which will dry very quickly on exposure in thin coats to the air, the shorter the heating the more slowly will the ink afterwards made with the oil dry.

Linseed oil must always be boiled in vessels where it has plenty of room, as the oil soon swells up and it begins to decompose so energetically at a particular temperature that there is considerable risk of its boiling over and catching fire. Various contrivances have been thought out for boiling large quantities of the oil with safety, such as pans with an outlet pipe in the side, through which the oil escapes when it rises too high instead of over the edge of the pan, and fires built on a trolley running on rails, so that they can at once be moved from under the pan if there is any probability of the latter boiling over. The best apparatus for preparing thickened linseed oil is undoubtedly one in which the oil offers a very large surface to the air, and on that account requires to be moderately heated only. The oil soon becomes very thick under these conditions and if necessary can be diluted to any required consistency with unboiled oil.

In boiling linseed oil down to the proper thickness by the old method there are two points demanding special attention. One is the liability of the oil to boil over, and the other consists in the development of large quantities of vapor, mostly of acroleine, which have a most powerful and disagreeable smell, and an intense action upon the eyes. The attendant must be protected from these fumes, and the boiling must therefore be done where there is a strong draught to take the fumes as fast as they are produced. There are various contrivances to cope with boiling over.

Savage's Printing Ink.—Pure balsam of copaiba, 9 ounces; lampblack, 3 ounces; indigo and Prussian blue, each 5 drachms; drachms; Indian red, ¾ ounce; yellow soap, 3 ounces. Mix, and grind to the utmost smoothness.

Toning Black Inks.—Printers' inks consisting solely of purified lampblack and vehicle give, of course, impressions which are pure black. It is, however, well known that a black which has to a practiced eye a tinge of blue in it looks much better than a pure black. To make such an ink many makers mix the lampblack with a blue pigment, which is added in very fine powder before the first grinding. Prussian blue is the pigment usually chosen and gives very attractive results. Prussian blue is, however, not a remarkable stable substance, and is very apt to turn brown from the formation of ferric oxide. Hence an ink made with Prussian blue, although it may look very fine at first, often assumes a dull brown hue in the course of time. Excellent substitutes for Prussian blue are to be found in the Induline blues. These are very fast dyes, and inks tinted with them do not change color. As pure indigo is now made artificially and sold at a reasonable price, this extremely fast dye can also be used for tinting inks made with purified lampblack.

To Give Dark Inks a Bronze or Changeable Hue.—Dissolve 1½ pounds gum shellac in 1 gallon 65 per cent alcohol or cologne spirits for 24 hours. Then add 14 ounces aniline red. Let it stand a few hours longer, when it will be ready for use. Add this to good blue, black, or other dark ink, as needed in quantities to suit, when if carefully done

they will be found to have a rich bronze or changeable hue.

Quick Dryer for Inks Used on Bookbinders' Cases.—Beeswax, 1 ounce; gum arabic (dissolved in sufficient acetic acid to make a thin mucilage), ½ ounce; brown japan, ½ ounce. Incorporate with 1 pound of good cut ink.

INKS FOR STAMP PADS.

The ink used on vulcanized rubber stamps should be such that when applied to a suitable pad it remains sufficiently fluid to adhere to the stamp. At the same time the fluidity should cease by the time the stamp is pressed upon an absorbing surface such as paper. Formerly these inks were made by rubbing up pigments in fat to a paste. Such inks can hardly be prevented, however, from making impressions surrounded by a greasy mark caused by the fat spreading in the pores of the paper. Now, most stamping inks are made without grease and a properly prepared stamping ink contains nothing but glycerine and coal-tar dye. As nearly all these dyes dissolve in hot glycerine the process of manufacture is simple enough. The dye, fuchsine, methyl violet, water blue, emerald green, etc., is put into a thin porcelain dish over which concentrated glycerine is poured, and the whole is heated to nearly 212° F. with constant stirring. It is important to use no more glycerine than is necessary to keep the dye dissolved when the ink is cold. If the mass turns gritty on cooling it must be heated up with more glycerine till solution is perfect.

In dealing with coal-tar dyes insoluble in glycerine, or nearly so, dissolve them first in the least possible quantity of strong, hot alcohol. Then add the glycerine and heat till the spirit is evaporated.

To see whether the ink is properly made spread some of it on a strip of cloth and try it with a rubber stamp. On paper, the separate letters must be quite sharp and distinct. If they run at the edges there is too much glycerine in the ink and more dye must be added to it. If, on the contrary, the impression is indistinct and weak, the ink is too thick and must be diluted by carefully adding glycerine.

Aniline colors are usually employed as the tinting agents. The following is a typical formula, the product being a black ink:

I.—Nigrosin	3 parts
Water	15 parts
Alcohol	15 parts
Glycerine	70 parts

Dissolve the nigrosin in the alcohol, add the glycerine previously mixed with the water, and rub well together.

Nigrosin is a term applied to several compounds of the same series which differ in solubility. In the place of these compounds it is probable that a mixture would answer to produce black as suggested by Hans Wilder for making writing ink. His formula for the mixture is:

II.—Methyl violet	3 parts
Bengal green	5 parts
Bismarck green	4 parts

A quantity of this mixture should be taken equivalent to the amount of nigrosin directed. These colors are freely soluble in water, and yield a deep greenish-black solution.

The aniline compound known as brilliant green answers in place of Bengal green. As to the permanency of color of this or any aniline ink, no guarantee is offered. There are comparatively few coloring substances that can be considered permanent even in a qualified sense. Among these, charcoal takes a foremost place. Lampblack remains indefinitely unaltered. This, ground very finely with glycerine, would yield an ink which would perhaps prove serviceable in stamping; but it would be liable to rub off to a greater extent than soluble colors which penetrate the paper more or less. Perhaps castor oil would prove a better vehicle for insoluble coloring matters. Almost any aniline color may be substituted for nigrosin in the foregoing formula, and blue, green, red, purple, and other inks obtained. Insoluble pigments might also be made to answer as suggested for lampblack.

The following is said to be a cushion that will give color permanently. It consists of a box filled with an elastic composition, saturated with a suitable color. The cushion fulfils its purpose for years without being renewed, always contains sufficient moisture, which is drawn from the atmosphere, and continues to act as a color stamp cushion so long as a remnant of the mass or composition remains in the box or receptacle. This cushion or pad is too soft to be self-supporting, but should be held in a low, flat pan, and have a permanent cloth cover.

III.—The composition consists preferably of 1 part gelatin, 1 part water, 6 parts glycerine, and 6 parts coloring matter. A suitable black color can be

made from the following materials: One part gelatin glue, 3 parts lampblack, aniline black, or a suitable quantity of logwood extract, 10 parts of glycerine, 1 part absolute alcohol, 2 parts water, 1 part Venetian soap, ½ part salicylic acid. For red, blue, or violet: One part gelatin glue, 2 parts aniline of desired color, 1 part absolute alcohol, 10 parts glycerine, 1 part Venetian soap, and ½ part salicylic acid.

The following are additional recipes used for this purpose:

IV.—Mix and dissolve 2 to 4 drachms aniline violet, 15 ounces alcohol, 15 ounces glycerine. The solution is poured on the cushion and rubbed in with a brush. The general method of preparing the pad is to swell the gelatin with cold water, then boil and add the glycerine, etc.

V.—Mix well 16 pounds of hot linseed oil, 3 ounces of powdered indigo, or a like quantity of Berlin blue, and 8 pounds of lampblack. For ordinary sign-stamping an ink without the indigo might be used. By substituting ultramarine or Prussian blue for the lampblack, a blue "ink" or paint would result.

Inks for Hand Stamps.—As an excipient for oily inks, a mixture of castor oil and crude oleic acid, in parts varying according to the coloring material used, is admirable. The following are examples:

Black.—Oil soluble nigrosin and crude oleic acid in equal parts. Add 7 to 8 parts of castor oil.

Red.—Oil soluble aniline red, 2 parts; crude oleic acid, 3 parts; castor oil, from 30 to 60 parts, according to the intensity of color desired.

Red.—Dissolve ¼ ounce of carmine in 2 ounces strong water of ammonia, and add 1 drachm of glycerine and ¾ ounce dextrin.

Blue.—Rub 1 ounce Prussian blue with enough water to make a perfectly smooth paste; then add 1 ounce dextrin, incorporate it well, and finally add sufficient water to bring it to the proper consistency.

Blue.—Oil soluble aniline blue, 1 part; crude oleic acid, 2 parts; castor oil, 30 to 32 parts.

Violet.—Alcohol, 15 ounces; glycerine, 15 ounces; aniline violet, 2 to 4 drachms. Mix, dissolve, pour the solution on the cushion, and dab on with a brush.

Color Stamps for Rough Paper.—It has hitherto been impossible to get a satisfactory application for printing with rubber stamps on rough paper. Fatty vehicles are necessary for such paper, and they injure the India rubber. It is said, however, that if the rubber is first soaked in a solution of glue, and then in one of tannin, or bichromate of potash, it becomes impervious to the oils or fats. Gum arabic can be substituted for the glue.

Indelible Hand-Stamp Ink.—

I.—Copper sulphate.... 20 parts
Aniline chlorate.... 20 parts

Rub up separately to a fine powder, then carefully mix, and add 10 parts of dextrin and incorporate. Add 5 parts of glycerine and rub up, adding water, a little at a time, until a homogeneous viscid mass is obtained. An aniline color is produced in the material, which boiling does not destroy.

II.—Sodium carbonate.. 22 parts
Glycerine..... 85 parts
Gum arabic, in powder..... 20 parts
Silver nitrate..... 11 parts
Ammonia water.... 20 parts
Venetian turpentine 10 parts

Triturate the carbonate of sodium, gum arabic, and glycerine together. In a separate flask dissolve the silver nitrate in the ammonia water, mix the solution with the triturate, and heat to boiling, when the turpentine is to be added, with constant stirring. After stamping, expose to the sunlight or use a hot iron. The quantity of glycerine may be varied to suit circumstances.

White Stamping Ink for Embroidery.—

Zinc white..... 2 drachms
Mucilage..... 1 drachm
Water..... 6 drachms

Triturate the zinc white with a small quantity of water till quite smooth, then add the mucilage and the remainder of the water.

STENCIL INKS.

I.—Dissolve 1 ounce of gum arabic in 6 ounces water, and strain. This is the mucilage. For *Black Color* use drop black, powdered, and ground with the mucilage to extreme fineness; for *Blue*, ultramarine is used in the same manner; for *Green*, emerald green; for *White*, flake white; for *Red*, vermilion, lake, or carmine; for *Yellow*, chrome yellow. When ground too thick they are thinned

with a little water. Apply with a small brush.

II.—Triturate together 1 pint pine soot and 2 pints Prussian blue with a little glycerine, then add 3 pints gum arabic and sufficient glycerine to form a thin paste.

Blue Stencil Inks.—The basis of the stencil inks commonly used varies to some extent, some preferring a mixture of pigments with oils, and others a watery shellac basis. The basis:

I.—Shellac	2	ounces
Borax	1½	ounces
Water	10	ounces

Boil together until 10 ounces of solution is obtained. The coloring:

Prussian blue	1	ounce
China clay	½	ounce
Powdered acacia	½	ounce

Mix thoroughly and gradually incorporate the shellac solution.

II.—Prussian blue	2	ounces
Lampblack	1	ounce
Gum arabic	3	ounces
Glycerine, sufficient.		

Triturate together the dry powders and then make into a suitable paste with glycerine.

Indelible Stencil Inks.—I.—Varnish such as is used for ordinary printing ink, 1 pound; black sulphuret of mercury, 1 pound; nitrate of silver, 1 ounce; sulphate of iron, 1 ounce; lampblack, 2 tablespoonfuls. Grind all well together; thin with spirits turpentine as desired.

II.—Sulphate of manganese, 2 parts; lampblack, 1 part; sugar, 4 parts; all in fine powder and triturated to a paste in a little water.

III.—Nitrate of silver, ¼ ounce; water, ¾ ounce. Dissolve, add as much of the strongest liquor of ammonia as will dissolve the precipitate formed on its first addition. Then add of mucilage, 1½ drachms, and a little sap green, syrup of buckthorn, or finely powdered indigo, to color. This turns black on being held near the fire, or touched with a hot iron.

SYMPATHETIC INKS:

Table of Substances Used in Making Sympathetic Inks.—

For writing and for bringing out the writing:

Cobalt chloride, heat.

Cobalt acetate and a little saltpeter, heat.

Cobalt chloride and nickel chloride mixed, heat.

Nitric acid, heat.

Sulphuric acid, heat.

Sodium chloride, heat.

Saltpeter, heat.

Copper sulphate and ammonium chloride, heat.

Silver nitrate, sunlight.

Gold trichloride, sunlight.

Ferric sulphate, infusion of gallnuts or ferrocyanide of potassium.

Copper sulphate, ferrocyanide of potassium.

Lead vinegar, hydrogen sulphide.

Mercuric nitrate, hydrogen sulphide.

Starch water, tincture of iodine or iodine vapors.

Cobalt nitrate, oxalic acid.

Fowler's solution, copper nitrate.

Soda lye or sodium carbonate, phenolphthaleine.

A sympathetic ink is one that is invisible when written, but which can be made visible by some treatment. Common milk can be used for writing, and exposure to strong heat will scorch and render the dried milk characters visible.

The following inks are developed by exposure to the action of reagents:

I.—Upon writing with a very clear solution of starch on paper that contains but little sizing, and submitting the dry characters to the vapor of iodine (or passing over them a weak solution of potassium iodide), the writing becomes blue, and disappears under the action of a solution of hyposulphite of soda (1 in 1,000).

II.—Characters written with a weak solution of the soluble chloride of platinum or iridium become black when the paper is submitted to mercurial vapor. This ink may be used for marking linen, as it is indelible.

III.—Sulphate of copper in very dilute solution will produce an invisible writing, which may be turned light blue by vapors of ammonia.

IV.—Soluble compounds of antimony will become red by hydrogen sulphide vapor.

V.—Soluble compounds of arsenic and of peroxide of tin will become yellow by the same vapor.

VI.—An acid solution of iron chloride is diluted until the writing is invisible when dry. This writing has the property of becoming red by sulphocyanide vapors (arising from the action of sulphuric acid on potassium sulphocyanide in a long-necked flask), and it disappears

by ammonia, and may alternately be made to appear and disappear by these two vapors.

VII.—Write with a solution of paraffine in benzol. When the solvent has evaporated, the paraffine is invisible, but becomes visible on being dusted with lampblack or powdered graphite or smoking over a candle flame.

VIII.—Dissolve 1 part of a lead salt, 0.1 part of uranium acetate, and the same quantity of bismuth citrate in 100 parts of water. Then add, drop by drop, a solution of sal ammoniac until the whole becomes transparent. Afterwards, mix with a few drops of gum arabic. To reveal the characters traced with this ink, expose them to the fumes of sulphuric acid, which turns them immediately to a dark brown. The characters fade away in a few minutes, but can be renewed by a slight washing with very dilute nitric acid.

TYPEWRITER RIBBON INKS.

I.—Take vaseline (petrolatum) of high boiling point, melt it on a water bath or slow fire, and incorporate by constant stirring as much lamp or powdered drop black as it will take up without becoming granular. If the vaseline remains in excess, the print is liable to have a greasy outline; if the color is in excess, the print will not be clear. Remove the mixture from the fire, and while it is cooling mix equal parts of petroleum, benzine, and rectified oil of turpentine, in which dissolve the fatty ink, introduced in small portions, by constant agitation. The volatile solvents should be in such quantity that the fluid ink is of the consistence of fresh oil paint. One secret of success lies in the proper application of the ink to the ribbon. Wind the ribbon on a piece of cardboard, spread on a table several layers of newspaper, then unwind the ribbon in such lengths as may be most convenient, and lay it flat on the paper. Apply the ink, after agitation, by means of a soft brush, and rub it well into the interstices of the ribbon with a toothbrush. Hardly any ink should remain visible on the surface. For colored inks use Prussian blue, red lead, etc., and especially the aniline colors.

II.—Aniline black	½ ounce
Pure alcohol	15 ounces
Concentrated glycerine	15 ounces

Dissolve the aniline black in the alcohol, and add the glycerine. Ink as before. The aniline inks containing glycerine are copying inks.

III.—Alcohol	2 ounces
Aniline color	½ ounce
Water	2 ounces
Glycerine	4 ounces

Dissolve the aniline in the alcohol and add the water and glycerine.

IV.—Castor oil	2 ounces
Cassia oil	½ ounce
Carbolic acid	½ ounce

Warm them together and add 1 ounce of aniline color. Indelible typewriter inks may be made by using lampblack in place of the aniline, mixing it with soft petrolatum and dissolving the cooled mass in a mixture of equal parts of benzine and turpentine.

COLORING AGENTS:

Red.—

I.—Bordeaux red, O. S.	15 parts
Aniline red, O. S.	15 parts
Crude oleic acid	45 parts
Castor oil enough to make	1,000 parts

Rub the colors up with the oleic acid, add the oil, warming the whole to 100° to 110° F. (not higher), under constant stirring. If the color is not sufficiently intense for your purposes, rub up a trifle more of it with oleic acid, and add it to the ink. By a little experimentation you can get an ink exactly to your desire in the matter.

Blue-Black.—

II.—Aniline black, O. S.	5 parts
Oleic acid, crude	5 parts
Castor oil, quantity sufficient to	100 parts.

Violet.—

III.—Aniline violet, O. S.	3 parts
Crude oleic acid	5 parts
Castor oil, quantity sufficient to	100 parts.

The penetration of the ink may be increased *ad libitum* by the addition of a few drops of absolute alcohol, or, better, of benzol.

Reinking.—For reinking ribbons use the following recipe for black: One ounce aniline black; 15 ounces pure grain alcohol; 15 ounces concentrated glycerine. Dissolve the aniline black in the alcohol and then add the glycerine. For blue use Prussian blue, and for red use red lead instead of the aniline black. This ink is also good for rubber stamp pads.

WRITING INKS.

The common writing fluids depend mostly upon galls, logwood, or aniline for coloring. There are literally thousands of formulas. A few of the most reliable have been gathered together here:

I.—Aleppo galls (well bruised), 4 ounces; clean soft water, 1 quart; macerate in a clean corked bottle for 10 days or a fortnight or longer, with frequent agitation; then add of gum arabic (dissolved in a wineglassful of water), 1½ ounces; lump sugar, ½ ounce. Mix well, and afterwards further add of sulphate of iron (green copperas crushed small), 1½ ounces. Agitate occasionally for 2 or 3 days, when the ink may be decanted for use, but is better if the whole is left to digest together for 2 or 3 weeks. When time is an object, the whole of the ingredients may at once be put into a bottle, and the latter agitated daily until the ink is made; and boiling water instead of cold water may be employed. Product, 1 quart of excellent ink, writing pale at first, but soon turning intensely black.

II.—Aleppo galls (bruised), 12 pounds; soft water, 6 gallons. Boil in a copper vessel for 1 hour, adding more water to make up for the portion lost by evaporation; strain, and again boil the galls with water, 4 gallons, for ½ hour; strain off the liquor, and boil a third time with water, 2½ gallons, and strain. Mix the several liquors, and while still hot add of green copperas (coarsely powdered), 4½ pounds; gum arabic (bruised small), 4 pounds. Agitate until dissolved, and after defecation strain through a hair sieve, and keep in a bunged cask for use. Product, 12 gallons.

III.—Aleppo galls (bruised), 14 pounds; gum, 5 pounds. Put them in a small cask, and add boiling soft water, 15 gallons. Allow the whole to macerate, with frequent agitation, for a fortnight, then further add of green copperas, 5 pounds, dissolved in water, 7 pints. Again mix well, and agitate the whole once daily for 2 or 3 weeks. Product, 15 gallons.

Brown Ink.—I.—To make brown ink, use for coloring a strong decoction of catechu; the shade may be varied by the cautious addition of a little weak solution of bichromate of potash.

II.—A strong decoction of logwood, with a very little bichromate of potash.

Blue Ink.—To make blue ink, substitute for the black coloring sulphate of indigo and dilute it with water till it produces the required color.

Anticorrosive or Asiatic Ink.—I.—Galls, 4 pounds; logwood, 2 pounds; pomegranate peel, 2 pounds; soft water, 5 gallons. Boil as usual; then add to the strained, decanted cold liquor, 1 pound of gum arabic, lump sugar or sugar candy, ¼ pound; dissolved in water, 3 pints. Product, 4½ gallons. Writes pale, but flows well from the pen, and soon darkens.

II.—Bruised galls, 14 pounds; gum, 5 pounds. Put them in a small cask, and add of boiling water, 15 gallons, Allow the whole to macerate, with frequent agitation, for 2 weeks, then further add green copperas, 5 pounds, dissolved in 7 pints water. Again mix well, and agitate the whole daily for 2 or 3 weeks.

Blue-Black Ink.—Blue Aleppo galls (free from insect perforations), 4½ ounces; bruised cloves, 1 drachm; cold water, 40 ounces; purified sulphate of iron, 1½ ounces; pure sulphuric acid (by measure), 35 minims; sulphate of indigo (in the form of a paste), which should be neutral, or nearly so, 1 ounce. The weights used are avoirdupois, and the measures apothecaries'. Place the galls, then bruised with the cloves, in a 50-ounce bottle, pour upon them the water, and digest, often daily shaking for a fortnight. Then filter through paper in another 50-ounce bottle. Get out also the refuse galls, and wring out of it the remaining liquid through a strong, clean linen or cotton cloth, into the filter, in order that as little as possible may be lost. Next put in the iron, dissolve completely, and filter through paper. Then the acid, and agitate briskly. Lastly, the indigo, and thoroughly mix by shaking. Pass the whole through paper; just filter out of one bottle into another until the operation is finished.

NOTE.—No gum or sugar is proper and on no account must the acid be omitted. When intended for copying, 5½ ounces of galls is the quantity. On the large scale this fine ink is made by percolation.

Colored Inks.—Inks of various colors may be made from a strong decoction of the ingredients used in dyeing, mixed with a little alum or other substance used as a mordant, and gum arabic. Any of the ordinary water-color cakes employed in drawing diffused through water may also be used for colored ink.

COPYING INK.

This is usually prepared by adding a little sugar to ordinary black ink, which for this purpose should be very rich in color, and preferably made galls prepared by heat. Writing executed with this ink may be copied within the space of 5 or 6 hours, by passing it through a copying press in contact with thin, unsized paper, slightly damped, enclosed between 2 sheets of thick oiled or waxed paper, when a reversed transcript will be obtained, which will read in proper order when the back of the copy is turned upwards. In the absence of a press a copy may be taken, when the ink is good and the writing very recent, by rolling the sheets, duly arranged on a ruler, over the surface of a flat, smooth table, employing as much force as possible, and avoiding any slipping or crumbling of the paper. Another method is to pass a warm flat-iron over the paper laid upon the writing. The following proportions are employed:

I.—Sugar candy or lump sugar, 1 ounce; or molasses or moist sugar, 1¼ ounces; rich black ink, 1½ pints; dissolve.

II.—Malt wort, 1 pint; evaporate it to the consistence of a syrup, and then dissolve it in good black ink, 1¼ pints.

III.—Solazza juice, 2 ounces; mild ale, ½ pint; dissolve, strain, and triturate with lampblack (previously heated to dull redness in a covered vessel), ¼ ounce; when the mixture is complete, add of strong black, 1½ pints; mix well, and in 2 or 3 hours decant the clear.

After making the above mixtures, they must be tried with a common steel pen, and if they do not flow freely, some more unprepared ink should be added until they are found to do so.

Alizarine Blue.—In 20 parts of fuming sulphuric acid dissolve 5 parts of indigo, and to the solution add 100 parts of extract of aqueous myrobalous and 10.5 parts iron filings or turning shavings. Finally add:

Gum arabic	1.5 parts
Sugar	7.5 parts
Sulphuric acid, 66° B.	10.5 parts
Aniline blue	1.5 parts
Carbolic acid	0.5 parts
Mirobalan extract to make	1,000 parts.

This ink when first used has a bluish tint, afterwards becoming black.

Alizarine Green.—In 100 parts of aqueous extract of gall apples dissolve:

Iron sulphate	30 parts
Copper sulphate	0.5 parts
Sulphuric acid	2 parts
Sugar	8 parts
Wood vinegar, rectified	50 parts
Indigo carmine	30 parts

Copying Ink for Copying Without a Press.—An ordinary thin-paper copying book may be used, and the copying done by transferrence. It is only necessary to place the page of writing in the letter book, just as one would use a leaf of blotting paper. The superfluous ink that would go into the blotting paper goes on to the leaf of the letter book, and showing through the thin paper gives on the other side of the leaf a perfect transcript of the letter. Any excess of ink on the page, either of the letter or of the copying paper, is removed by placing a sheet of blotting paper between them, and running one's hand firmly over the whole in the ordinary manner. This ready transcription is accomplished by using ink which dries slowly. Obviously the ink must dry sufficiently slowly for the characters at the top of a page of writing to remain wet when the last line is being written, while it must dry sufficiently to preclude any chance of the copied page being smeared while subsequent pages are being covered. The drying must also be sufficiently rapid to prevent the characters "setting off," as printers term it, from one page on to another after folding. The formula for the requisite ink is very simple:

Reduce by evaporation 10 volumes of any good ink to 6, then add 4 volumes of glycerine. Or manufacture some ink of nearly double strength, and add to any quantity of it nearly an equal volume of glycerine.

Gold Ink.—Mosaic gold, 2 parts; gum arabic, 1 part; rubbed up to a proper condition.

Green Ink.—A good, bright green, aniline ink may be made as follows:

Aniline green (soluble)	2 parts
Glycerine	16 parts
Alcohol	112 parts
Mucilage of gum arabic	4 parts

Dissolve the aniline in the alcohol, and add the other ingredients. Most of the gum arabic precipitates, but according to the author of the formula (Nelson) it has the effect of rendering the ink slow flowing enough to write with. Filter.

Hectograph Inks (see also Hectograph).—I.—**Black.**—Methyl violet, 10 parts; nigrosin, 20 parts; glycerine, 30 parts; gum arabic, 5 parts; alcohol, 60 parts.

II.—**Blue.**—Resorcin blue M, 10 parts. Dissolve by means of heat in a mixture of:

Dilute acetic acid	1 part
Distilled water	85 parts
Glycerine	4 parts
Alcohol, 90 per cent	10 parts

III.—**Green.**—Aniline green, water solution, 15 parts; glycerine, 10 parts; Water, 50 parts; alcohol, 10 parts.

Paste Ink to Write with Water.—I.—**Black.**—Take 4 parts of bichromate of potash, pulverized, and mixed with 25 parts of acetic acid; 50 parts of liquid extract of logwood; ¼ part of picric acid; 10 parts of pulverized sal sorrel; 10 parts of mucilage; and ¼ part of citrate of iron, and mix well. The liquid extract of logwood is prepared by mixing 3 parts of an extract of common commercial quality with 2 parts of water.

II.—**Red.**—Take 1 part of red aniline mixed with 10 parts of acetic acid; 5 parts of citric acid, and 25 parts of mucilage, all well mixed. For use, mix 1 part of the paste with 16 parts of water.

III.—**Blue.**—Take 2 parts of aniline blue mixed with 10 parts of acetic acid; 5 parts of citric acid, and 40 parts of mucilage, all well mixed. For use, mix 1 part of the paste with 8 parts of water.

IV.—**Violet.**—Use the same ingredients in the same proportions as blue, with the difference that violet aniline is used instead of blue aniline.

V.—**Green.**—Take 1 part of aniline blue; 3 parts of picric acid, mixed with 10 parts of acetic acid; 3 parts of citric acid, and 80 parts of mucilage. For use, 1 part of this paste is mixed with 8 parts of water.

VI.—**Copying.**—Take 6 parts of pulverized bichromate of potash, mixed with 10 parts of acetic acid and 240 parts of liquid extract of logwood, and add a pulverized mixture of 35 parts of alum, 20 parts of sal sorrel, and 20 parts mucilage. Mix well. For use, 1 part of this paste is mixed with 4 parts of hot water.

Purple Ink.—I.—A strong decoction of logwood, to which a little alum or chloride of tin has been added.

II. (**Normandy**).—To 12 pounds of Campeachy wood add as many gallons of boiling water. Pour the solution through a funnel with a strainer made of coarse flannel, or 1 pound of hydrate, or acetate of deutoxide of copper finely powdered (having at the bottom of the funnel a piece of sponge); then add immediately 14 pounds of alum, and for every 340 gallons of liquid add 80 pounds of gum arabic or gum senegal. Let these remain for 3 or 4 days, and a beautiful purple color will be produced.

Red Ink.—Brazil wood, ground, 4 ounces; white wine vinegar, hot, 1¼ pints. Digest in a glass or a well-tinned copper or enamel saucepan, until the next day; then gently simmer for half an hour, adding toward the end gum arabic and alum, of each, ½ ounce.

Inks for Shading Pen.—The essential feature in the ink for use with a shading pen is simply the addition of a sufficient quantity of acacia or other mucilaginous substance to impart a proper degree of consistency to the ink. A mixture of 2 parts of mucilage of acacia with 8 of ink gives about the required consistency. The following formulas will probably be found useful:

I.—Water-soluble nigrosin	1 part
Water	9 parts
Mucilage acacia	1 part
II.—Paris violet	2 parts
Water	6 parts
Mucilage acacia	2 parts
III.—Methyl violet	1 part
Distilled water	7 parts
Mucilage acacia	2 parts
IV.—Bordeaux red	3 parts
Alcohol	2 parts
Water	20 parts
Mucilage acacia	2 parts
V.—Rosaniline acetate	2 parts
Alcohol	1 part
Water	10 parts
Mucilage acacia	2 parts

Silver Ink.—I.—Triturate in a mortar equal parts of silver foil and sulphate of potassa, until reduced to a fine powder; then wash the salt out, and mix the residue with a mucilage of equal parts of gum arabic water.

II.—Make as gold ink, but use silver leaf or silver bronze powder.

III.—Oxide of zinc	30 grains
Mucilage	1 ounce
Spirit of wine	40 drops
Silver bronze	3 drachms

Rub together, until perfectly smooth.

the zinc and mucilage, then add the spirit of wine and silver bronze and make up the quantity to 2 ounces with water.

Violet Ink.—I.—For 2 gallons, heat 2 gills of alcohol on a water bath. Add to the alcohol 2 ounces of violet aniline, and stir till dissolved; then add the mixture to 2 gallons of boiling water; mix well, and it is ready for use. Smaller quantities in proportion.

II.—Another good violet ink is made by dissolving some violet aniline in water to which some alcohol has been added. It takes very little aniline to make a large quantity of the ink.

White Ink (for other White Inks see Blueprint Inks).—So-called white inks are, properly speaking, white paints, as a white solution cannot be made. A paint suitable for use as an "ink" may be made by grinding zinc oxide very fine on a slab with a little tragacanth mucilage, and then thinning to the required consistency to flow from the pen. The mixture requires shaking or stirring from time to time to keep the pigment from separating. The "ink" may be preserved by adding a little oil of cloves or other antiseptic to prevent decomposition of the mucilage.

White marks may sometimes be made on colored papers by the application of acids or alkalies. The result, of course, depends on the nature of the coloring matter in each instance, and any "ink" of this kind would be efficacious or otherwise, according to the coloring present in the paper.

Yellow Ink.—I.—Gamboge (in coarse powder), 1 ounce; hot water, 5 ounces. Dissolve, and when cold, add of spirit, ¾ ounce.

II.—Boil French berries, ½ pound, and alum, 1 ounce, in rain water, 1 quart, for ½ an hour, or longer, then strain and dissolve in the hot liquor gum arabic, 1 ounce.

Waterproof Ink (see also Indelible Inks).—Any ordinary ink may be made waterproof by mixing with it a little ordinary glue. After waterproofing ink in this way it is possible to wash drawings with soap and water, if necessary, without the ink running at all.

White Stamping Ink.—

Zinc white	2 drachms
White precipitate	5 grains
Mucilage	1 drachm
Water	6 drachms

Triturate the zinc white with a small quantity of water till quite smooth, then add the mucilage and the remainder of the water.

INK—LUMINOUS:

½ dram phosphorous
½ ounce oil cinnamon

Mix in phial, cork tightly and heat slowly until mixed. This ink can be read in the dark.

Note.—This ink is poisonous. Phosphorous is also inflammable and must be handled with a wood or glass spoon, never with the bare hands.

INLAYING BY ELECTROLYSIS.

See also Electro-etching, under Eteching.

The process consists in engraving the design by means of the sand-blast and stencils on the surface of the article. The design or pattern is rendered conductive and upon this conductive surface a precipitate of gold, silver, platinum, etc., is applied, and fills up the hollows. Subsequently the surface is ground smooth.

Insect Bites

REMEDIES FOR INSECT BITES.

I.—Carbolic acid	15	grains
Glycerine	2	drachms
Rose water	4	ounces
II.—Salicylic acid	15	grains
Collodion	2½	drachms
Spirit of ammonia	5½	drachms
III.—Fluid extract rhus toxicodendron	1	drachm
Water	8	ounces
IV.—Ipecac, in powder	1	drachm
Alcohol	1	ounce
Ether	1	ounce
V.—Betanaphthol	30	grains
Camphor	30	grains
Lanolin cold cream	1	ounce

VI.—Spirit of sal ammoniac, whose favorable action upon fresh insect bites is universally known, is often unavailable. A simple means to alleviate the pain and swelling due to such bites, when still fresh, is cigar ashes. Place a little ashes upon the part stung, add a drop of water—in case of need beer, wine, or coffee may be used instead—and rub the resulting paste thoroughly into the skin. It is preferable to use fresh ashes of tobacco, because the recent heat offers sufficient guarantee for absolute freedom from impurities. The action of the tobacco ashes is due to the presence of

potassium carbonate, which, like spirit of sal ammoniac, deadens the effect of the small quantities of acid (formic acid, etc.) which have been introduced into the small wound by the biting insect.

Insecticides

(See also Petroleum.)

The Use of Hydrocyanic Acid Gas for Exterminating Household Insects.—Recent successful applications of hydrocyanic acid gas for the extermination of insects infecting greenhouse plants have suggested the use of the same remedy for household pests. It is now an established fact that 1½ grains of 98 per cent pure cyanide of potassium volatilized in a cubic foot of space, will, if allowed to remain for a period of not less than 3 hours, kill all roaches and similar insects.

It may be stated that a dwelling, office, warehouse, or any building may be economically cleared of all pests, provided that the local conditions will permit the use of this gas. It probably would be dangerous to fumigate a building where groceries, dried fruits, meats, or prepared food materials of any kind are stored. Air containing more than 25 per cent of the gas is inflammable; therefore it would be well to put out all fire in an inclosure before fumigating. Hydrocyanic acid, in all its forms, is one of the most violent poisons known, and no neglect should attend its use. There is probably no sure remedy for its effects after it has once entered the blood of any of the higher animals. When cyanide of potassium is being used it should never be allowed to come in contact with the skin, and even a slight odor of the gas should be avoided. Should the operator have any cut or break in the skin of the hands or face it should be carefully covered with court-plaster to prevent the gas coming in contact with the flesh, or a small particle of the solid compound getting into the cut might cause death by poisoning in a few minutes' time.

Hydrocyanic acid gas should not be used in closely built apartments with single walls between, as more or less of the gas will penetrate a brick wall. An inexperienced person should never use cyanide of potassium for any purpose, and if it be found practicable to treat buildings in general for the extermination of insects, the work should be done only under the direction of competent officials. Experiments have shown that a smaller dose and a shorter period of exposure are required to kill mice than for roaches and household insects generally, and it readily follows that the larger animals and human beings would be more quickly overcome than mice, since a smaller supply of pure air would be required to sustain life in mice, and small openings are more numerous than large ones.

The materials employed and the method of procedure are as follows: After ascertaining the cubic content of the inclosure, provide a glass or stoneware (not metal) vessel of 2 to 4 gallons capacity for each 5,000 cubic feet of space to be fumigated. Distribute the jars according to the space, and run a smooth cord from each jar to a common point near an outside door where they may all be fastened; support the cord above the jar by means of the back of a chair or other convenient object in such a position that when the load of cyanide of potassium is attached it will hang directly over the center of the jar. Next weigh out upon a piece of soft paper about 17 ounces of 98 per cent pure cyanide of potassium, using a large pair of forceps for handling the lumps; wrap up and place in a paper bag and tie to the end of the cord over the jar. After the load for each jar has been similarly provided, it is well to test the working of the cords to see that they do not catch or bind. Then remove the jar a short distance from under the load of cyanide and place in it a little more than a quart of water, to which slowly add 1½ pints of commercial sulphuric acid, stirring freely. The action of the acid will bring the temperature of the combination almost to the boiling point. Replace the jars beneath the bags of cyanide, spreading a large sheet of heavy paper on the floor to catch any acid that may possibly fly over the edge of the jar when the cyanide is dropped, or as a result of the violent chemical action which follows. Close all outside openings and open up the interior of the apartment as much as possible, in order that the full strength of the gas may reach the hiding places of the insects. See that all entrances are locked or guarded on the outside to prevent persons entering; then leave the building, releasing the cords as you go. The gas will all be given off in a few minutes, and should remain in the building at least 3 hours.

When the sulphuric acid comes in contact with the cyanide of potassium the result is the formation of sulphate of potash, which remains in the jar, and the hydrocyanic acid is liberated and es-

capes into the air. The chemical action is so violent as to cause a sputtering, and frequently particles of the acid are thrown over the sides of the jar; this may be prevented by supporting a sheet of stiff paper over the jar by means of a hole in the center, through which the cord supporting the cyanide of potassium is passed, so that when the cord is released the paper will descend with the cyanide and remain at rest on the top of the jar, but will not prevent the easy descent of the cyanide into the acid. The weight of this paper will in no way interfere with the escape of the gas.

At the end of the time required for fumigation, the windows and doors should be opened from the outside and the gas allowed to escape before anyone enters the building. A general cleaning should follow, as the insects leave their hiding places and, dying on the floors, are easily swept up and burned. The sulphate of potash remaining in the jars is poisonous and should be immediately buried and the jars themselves filled with earth or ashes. No food that has remained during fumigation should be used, and thorough ventilation should be maintained for several hours. After one of these experiments it was noted that ice water which had remained in a closed cooler had taken up the gas, and had both the odor and taste of cyanide.

For dwellings one fumigation each year would be sufficient, but for storage houses it may be necessary to make an application every 3 or 4 months to keep them entirely free from insect pests. The cost of materials for one application is about 50 cents for each 5,000 cubic feet of space to be treated. The cyanide of potassium can be purchased at about 35 cents per pound, and the commercial sulphuric acid at about 4 cents per pound. The strength of the dose may be increased and the time of exposure somewhat shortened, but this increases the cost and does not do the work so thoroughly. In no case, however, should the dose remain less than 1 hour.

The application of this method of controlling household insects and pests generally is to be found in checking the advance of great numbers of some particular insect, or in eradicating them where they have become thoroughly established. This method will be found very advantageous in clearing old buildings and ships of cockroaches.

APPLICATIONS FOR CATTLE, POULTRY, ETC.:

See also Veterinary Formulas.

Fly Protectives for Animals.—

I.—Oil of cloves.....	3 parts
Bay oil.....	5 parts
Eucalyptus tincture	5 parts
Alcohol.....	150 parts
Water.....	200 parts

II.—Tar well diluted with grease of any kind is as effective an agent as any for keeping flies from cattle. The mixture indicated has the advantage of being cheap. Applying to the legs, neck, and ears will usually be sufficient.

Cattle Dip for Ticks.—Dr. Noorgard of the Bureau of Animal Industry finds the following dip useful, immersion lasting one minute:

Sulphur.....	86 pounds
Extra dynamo oil..	1,000 gallons

Insecticides for Animals.—

I.—Bay oil.....	500	Parts by weight.
Naphthalene.. ..	100	
Camphor.....	60	
Animal oil.....	25	
II.—Bay oil, pressed..	400	
Naphthalene	100	
Crude carbolic acid	10	

For Dogs, Cats, etc.—The following is an excellent powder for the removal of fleas from cats or dogs:

Naphthalene ..	4 av. ounces
Starch.....	12 av. ounces

Reduce to fine powder. A few grains of lampblack added will impart a light gray color, and if desirable a few drops of oil of pennyroyal or eucalyptus will disguise the naphthalene odor.

Rub into the skin of the animal and let the powder remain for a day or two, when the same can be removed by combing or giving a bath, to which some infusion of quassia or quassia chips has been added. This treatment is equally efficient for lice and ticks.

Poultry Lice Destroyer.—I.—Twenty pounds sublimed sulphur; 8 pounds fuller's earth; 2 pounds powdered naphthalene; ½ ounce liquid carbolic acid. Mix thoroughly and put up in half-pound tins or boxes. Sprinkle about the nest for use.

II.—Oil of eucalyptus smeared about the coop will cause the parasites to leave. To drive them out of the nests of sitting hens, place in the nest an egg that has been emptied, and into which has been inserted a bit of sponge imbibed in essence of eucalyptus. There may be used also a concentrated solution of extract of tobacco, to which phenol has been added.

III.—Cover the floor or soil of the house with ground or powdered plaster, taken from old walls, etc.

ANT DESTROYERS:

A most efficacious means of getting rid of ants is spraying their resorts with petroleum. The common oil is worth more for this purpose than the refined. Two thorough sprayings usually suffice.

In armoires, dressing cases, etc., oil of turpentine should be employed. Pour it in a large plate, and let it evaporate freely. Tobacco juice is another effective agent, but both substances have the drawback of a very penetrating and disagreeable odor.

Boiling water is deadly to ants wherever it can be used (as in the garden, or yard around the house). So is carbon disulphide injected into the nests by aid of a good, big syringe. An emulsion of petroleum and water (oil, 1 part; water, 3 parts) poured on the earth has proven very efficacious, when plentifully used (say from 1 ounce to 3 ounces to the square yard). A similar mixture of calcium sulphide and water (calcium sulphide, 100 parts; water, 1,000 parts; and the white of 1 egg to every quart of water) poured into their holes is also effective.

A weak solution of corrosive sublimate is very deadly to ants. Not only does it kill them eventually, but it seems to craze them before death, so that ants of the same nest, after coming into contact with the poison, will attack each other with the greatest ferocity.

Where ants select a particular point for their incursions it is a good plan to surround it with a "fortification" of obnoxious substance. Sulphur has been used successfully in this way, and so has coal oil. The latter, however, is not a desirable agent, leaving a persistent stain and odor.

The use of carbon disulphide is recommended to destroy ants' nests on lawns. A little of the disulphide is poured into the openings of the hills, stepping on each as it is treated to close it up. The volatile vapors of the disulphide will penetrate the chambers of the nest in every direction, and if sufficient has been used will kill not only the adult insects but the larvæ as well. A single treatment is generally sufficient.

Formulas to Drive Ants Away.—

I.—Water..... 1 quart
Cape aloes..... 4 ounces
Boil together and add:
Camphor in small pieces..... 1½ ounces

II.—Powdered cloves.... 1 ounce
Insect powder..... 1 ounce
Scatter around where ants infest.

III.—Cape aloes..... ½ pound
Water..... 4 pints
Boil together and add camphor gum, 3 ounces. Sprinkle around where the ants infest.

BEDBUG DESTROYERS.

A good bug killer is benzine, pure and simple, or mixed with a little oil of mirbane. It evaporates quickly and leaves no stain. The only trouble is the inflammability of its vapor.

The following is a popular preparation: To half a gallon of kerosene oil add a quart of spirit of turpentine and an ounce of oil of pennyroyal. This mixture is far less dangerous than benzine. The pennyroyal as well as the turpentine are not only poisonous but exceedingly distasteful to insects of all kinds. The kerosene while less quickly fatal to bugs than benzine is cheaper and safer, and when combined with the other ingredients becomes as efficient.

Where the wall paper and wood work of a room have become invaded, the usual remedy is burning sulphur. To be efficient the room must have every door, window, crevice, and crack closed. The floor should be wet in advance so as to moisten the air. A rubber tube should lead from the burning sulphur to a key-hole or auger-hole and through it, and by aid of a pair of bellows air should be blown to facilitate the combustion of the sulphur.

Pastes.—Some housewives are partial to corrosive sublimate for bedbugs; but it is effective only if the bug eats the poison. The corrosive sublimate cannot penetrate the waxy coat of the insect. But inasmuch as people insist on having this a few formulas are given.

I.—Common soap..... 1 av. ounce
Ammonium chloride..... 3 av. ounces
Corrosive sublimate 3 av. ounces
Water enough to make 32 fluid-ounces.

Dissolve the salts in the water and add the soap.

This will make a paste that can be painted with a brush around in the cracks and crevices. Besides, it will make an excellent filling to keep the cracks of the wall and wainscoting free from bugs of all kinds. The formula could be modified so as to permit the use

of Paris green or London purple, if desired. A decoction of quassia could be used to dissolve the soap. The latter paste would, of course, not be poisonous, and in many instances it would be preferred. It is possible to make a cold infusion of white hellebore of 25 per cent strength, and in 1 quart of infusion dissolve 1 ounce of common soap. The advantage of the soap paste is simply to keep the poisonous substance thoroughly distributed throughout the mass at all times. The density of the paste can be varied to suit. Kerosene oil or turpentine could replace 6 ounces or 8 ounces of the water in making the paste, and either of these would make a valuable addition.

Another paste preparation which will meet with hearty recommendation is blue ointment. This ointment, mixed with turpentine or kerosene oil, can be used to good advantage; especially so as the turpentine is so penetrating that both it and the mercury have a chance to act more effectually. It can be said that turpentine will kill the bedbug if the two come in contact; and kerosene is not far behindhand in its deadly work.

II.—Blue ointment.....	1 ounce
Turpentine.....	3 ounces

Stir well together.

Liquid Bedbug Preparations.—There is no doubt that the liquid form is the best to use; unlike a powder, or even a paste, it will follow down a crack into remote places where bugs hide, and will prevent their escape, and it will also kill the eggs and nits. The following substances are the most employed, and are probably the best: Kerosene, turpentine, benzine, carbolic acid, corrosive sublimate solution, oil pennyroyal, and strong solution of soap. Here are several good formulas that can be depended upon:

I.—Oil of pennyroyal...	1 drachm
Turpentine.....	8 ounces
Kerosene oil, enough to make	1 gallon.

Put up in 8-ounce bottles as a bedbug exterminator.

II.—Oil of eucalyptus...	1 drachm
Eucalyptus leaves...	1 ounce
Benzine.....	2 ounces
Turpentine.....	2 ounces
Kerosene enough to make	16 ounces.

Mix the turpentine, benzine, and kerosene oil, and macerate the eucalyptus leaves in it for 24 hours; then strain and make up the measure to 1 pint, having first added the oil of eucalyptus.

FLY-KILLERS.

A fly poison that is harmless to man may be made from quassia wood as follows:

Quassia.....	1,000 parts
Molasses	150 parts
Alcohol.....	50 parts
Water.....	5,750 parts

Macerate the quassia in 500 parts of water for 24 hours, boil for half an hour, set aside for 24 hours, then press out the liquid. Mix this with the molasses and evaporate to 200 parts. Add the alcohol and the remaining 750 parts of water, and without filtering, saturate absorbent paper with it.

This being set out on a plate with a little water attracts the flies, which are killed by partaking of the liquid.

Sticky Preparations.—

I.—Rosin.....	150 parts
Linseed oil.....	50 parts
Honey.....	18 parts

Melt the rosin and oil together and stir in the honey.

II.—Rapeseed oil.....	70 parts
Rosin.....	30 parts

Mix and melt together.

III.—Rosin.....	60 parts
Linseed oil.....	38 parts
Yellow wax.....	2 parts

IV.—Rosin.....	10 parts
Turpentine.....	5 parts
Rapeseed oil.....	5 parts
Honey.....	1 part

Sprinkling Powders for Flies.—

I.—Long peppers, powdered.....	5 parts
Quassia wood, powdered.....	5 parts
Sugar, powdered....	10 parts

Mix, moisten the mixture with 4 parts of alcohol, dry, and again powder. Keep the powder in closely stoppered jars, taking out a sufficient quantity as desired.

II.—Orris root, powdered	4 parts
Starch, powdered....	15 parts
Eucalyptol.....	1 part

Mix. Keep in a closely stoppered jar or box. Strew in places affected by flies.

Fly Essences.—

I.—Eucalyptol.....	10 parts
Bergamot oil.....	3 parts
Acetic ether.....	10 parts
Cologne water.....	50 parts
Alcohol, 90 per cent.	100 parts

Mix. One part of this "essence" is

to be added to 10 parts of water and sprayed around the rooms frequently.

II.—Eucalyptol.....	10 parts
Acetic ether.....	5 parts
Cologne water.....	40 parts
Tincture of insect powder (1:5)....	50 parts

REMEDIES AGAINST HUMAN PARASITES:

	By weight
I.—Yellow wax.....	85 parts
Spermaceti.....	60 parts
Sweet oil.....	500 parts
Melt and add:	
Boiling distilled water.....	150 parts
After cooling add:	
Clove oil.....	2 parts
Thyme oil.....	3 parts
Eucalyptus oil....	4 parts
II.—Bay oil, pressed...	100 parts
Acetic ether.....	12 parts
Clove oil.....	4 parts
Eucalyptus oil.....	3 parts

For Head Lice in Children.—One of the best remedies is a vinegar of sabadilla. This is prepared as follows: Sabadilla seed, 5 parts; alcohol, 5 parts; acetic acid, 9 parts; and water, 36 parts. Macerate for 3 days, express and filter. The directions are: Moisten the scalp and hair thoroughly at bedtime, binding a cloth around the head, and let remain overnight. If there are any sore spots on the scalp, these should be well greased before applying the vinegar.

To Exterminate Mites.—Mix together 10 parts of naphthalene, 10 parts of phenic acid, 5 parts of camphor, 5 parts of lemon oil, 2 parts of thyme oil, 2 parts of oil of lavender, and 2 parts of the oil of juniper, in 500 parts of pure alcohol.

Vermin Killer.—

Sabadilla, powder..	2 av. ounces
Acetic acid.....	½ fluidounce
Wood alcohol.....	2 fluidounces
Water sufficient to make 16 fluid ounces.	

Mix the acetic acid with 14 fluidounces of water and boil the sabadilla in this mixture for 5 to 10 minutes, and when nearly cold add the alcohol, let stand, and decant the clear solution and bottle.

Directions: Shake the bottle and apply to the affected parts night and morning.

INSECTICIDES FOR PLANTS.

Two formulas for insecticides with especial reference to vermin which attack plants:

I.—Kerosene.....	2 gallons
Common soap.....	½ pound
Water.....	1 gallon

Heat the solution of soap, add it boiling hot to the kerosene and churn until it forms a perfect emulsion. For use upon scale insects it is diluted with 9 parts of water; upon other ordinary insects with 15 parts of water, and upon soft insects, like plant lice, with from 20 to 25 parts of water.

For lice, etc., which attack the roots of vines and trees the following is recommended:

II.—Caustic soda	5 pounds
Rosin.....	40 pounds
Water, a sufficient quantity.	

Dissolve the soda in 4 gallons of water, by the aid of heat, add the rosin and after it is dissolved and while boiling add, slowly, enough water to make 50 gallons. For use, 1 part of this mixture is diluted with 10 parts of water and about 5 gallons of the product poured into a depression near the root of the vine or tree.

For Cochineal Insects.—An emulsion for fumagine (malady of orange trees caused by the cochineal insect) and other diseases caused by insects is as follows:

Dissolve, hot, 4 parts of black soap in 15 parts of hot water. Let cool to 104° F., and pour in 10 parts of ordinary petroleum, shaking vigorously. Thus an emulsion of *café au lait* color is obtained, which may be preserved indefinitely. For employment, each part of the emulsion is diluted, according to circumstances, with from 10 to 20 parts of water.

For Locusts.—Much trouble is experienced in the Transvaal and Natal with locust pests, the remedies used being either a soap spray, containing 1 pound ordinary household soap in 5 gallons of water, or arsenite of soda, the latter being issued by the government for the purpose, and also used for the destruction of prickly pear, and as a basis of tick dips. A solution of 1 pound in 10 gallons of water is employed for full-grown insects, and of 1 pound in 20 gallons of water for newly hatched ones, 1 pound of sugar being added to each pound of arsenite dissolved. The solution sometimes causes sores on the skin, and the natives employed in its use are given grease to rub over themselves as a measure of protection. An advantage of the arsenite solution over soap is that much less liquid need be used.

A composition for the destruction of pear blight, which has been patented in

the United States, is as follows: Peppermint oil, 16 parts; ammonia water, 60 parts; calomel, 30 parts; and linseed oil, 1,000 parts.

For Moths and Caterpillars.—

I.—Venice turpentine	200	parts
Rosin	1,000	parts
Turpentine	140	parts
Tar	80	parts
Lard	500	parts
Rape oil	240	parts
Tallow	200	parts
II.—Rosin	50	parts
Lard	40	parts
Stearine oil	40	parts

For Non-Masticating Insects.—For protection against all non-masticating and many mandibulate insects, kerosene oil is much used. It is exhibited in the form of emulsion, which may be made as follows:

Kerosene	2 gallons
Common soap	8 ounces
Water	1 gallon

Dissolve the soap in the water by the aid of heat, bring to the boiling point, and add the kerosene in portions, agitating well after each addition. This is conveniently done by means of the pump to be used for spraying the mixture.

For Scale Insects.—For destroying scale insects dilute the cochineal emulsion (see above) with 9 times its volume of water; in the case of most others, except lice, dilute with 14 volumes, and for the latter with 20 to 25 volumes.

For the extermination of scale insects, resinous preparations are also employed, which kill by covering them with an impervious coating. Such a wash may be made as follows:

Rosin	3½ pounds
Caustic soda	1 pound
Fish oil	8 ounces
Water	20 gallons

Boil the rosin, soda, and oil with a small portion of the water, adding the remainder as solution is effected.

For the San José scale a stronger preparation is required, the proportion of water being decreased by half, but such a solution is applied only when the tree is dormant.

Scale Insects on Orange Trees.—Scale insect enemies of orange trees are directly controlled in two ways: (1) By spraying the infested trees with some liquid insecticide, and (2) by subjecting them to the fumes of hydrocyanic acid gas, commonly designated as "gassing." The latter method is claimed to be the most effective means known of destroying scale insects. In practice the method consists in closing a tree at night with a tent and filling the latter with the poisonous fumes generated by treating refined potassium cyanide (98 per cent) with commercial sulphuric acid (66 per cent) and water. The treatment should continue from 30 to 40 minutes, the longer time being preferable. The work is done at night to avoid the scalding which follows day applications, at least in bright sunshine.

The oily washes are said to be the best for the use by the spraying method. "Kerosene emulsion" is a type of these washes. A formula published by the United States Department of Agriculture follows: Kerosene, 2 gallons; whale-oil soap, ½ pound; water, 1 gallon. The soap is dissolved in hot water, the kerosene added, and the whole thoroughly emulsified by means of a power pump until a rather heavy, creamy emulsion is produced. The quantity of soap may be increased if desired. The insecticide is applied by spraying the infected tree with an ordinary force pump with spraying nozzle.

Coating Against the Plant Louse.—(*a*)—Mix 75 parts of green soap, 50 parts of linseed oil, and 25 parts of carbolic acid. Afterwards mix the mass with 15,000 parts of water.

(*b*) Mix 4 parts of carbolic acid with 100 parts water glass.

Louse Washes.—

Unslaked lime	18	parts
Sulphur	9	parts
Salt	6.75	parts

Mix as follows: A fourth part of the lime is slaked and boiled for ⅔ of an hour with the sulphur in 22.6 parts of water. The remainder of the lime is then slaked and added with the salt to the hot mixture. The whole is burned for another half hour or an hour, and then diluted to 353 parts. The fluid is applied lukewarm when the plants are not in active growth.

For Slugs on Roses.—

Powdered pyrethrum	8 ounces
Powdered colocynth	4 ounces
Powdered hellebore	16 ounces

Flea Powder.—

Naphthalene	4 ounces
Talcum	10 ounces
Tobacco dust	2 ounces

To Keep Flaxseed Free from Bugs.—As a container use a tin can with a close-fitting top. At the bottom of the can place a small vial of chloroform with a loose-fitting cork stopper. Then pour the flaxseed, whole or ground, into the can, covering the vial. Enough of the chloroform will escape from the vial to kill such insects as infest the flaxseed.

INSECT POWDERS.

Pyrethrum, whale oil (in the form of soap), fish oil (in the form of soap), soft soap, paraffine, Prussic acid, Paris green, white lead, sulphur, carbon bisulphide, acorus calamus, camphor, Cayenne pepper, tobacco, snuff, asafetida, white hellebore, eucalyptol, quassia, borax, acetic ether are most important substances used as insecticides, alone, or in combination of two or more of them. The Prussic acid and Paris green are dangerous poisons and require to be used with extreme care:

Insect powder is used for all small insects and as a destroyer of roaches. The observations of some experimenters seem to show that the poisonous principle of these flowers is non-volatile, but the most favorable conditions under which to use them are in a room tightly closed and well warmed. There may be two poisonous principles, one of which is volatile. Disappointment sometimes arises in their use from getting powder either adulterated, or which has been exposed to the air and consequently lost some of its efficiency.

The dust resulting from the use of insect powder sometimes proves irritating to the mucous membranes of the one applying the powder. This is best avoided by the use of a spray atomizer.

Persistence in the use of any means is an important element in the work of destroying insects. A given poison may be employed and no visible result follow at first, when in reality many may have been destroyed, enough being left to deceive the observer as to numbers. They multiply very rapidly, too, it must be remembered, and vigorous work is required to combat this increase. Where they can easily migrate from one householder's premises to those of another, as in city "flats," it requires constant vigilance to keep them down, and entire extermination is scarcely to be expected.

The ordinary insect powder on the market is made from pyrethrum carneum, pyrethrum roseum, and pyrethrum cinerariæ-folium. The first two are generally ground together and are commercially called Persian insect powder; while the third is commonly called Dalmatian insect powder. These powders are sold in the stores under many names and in combination with other powders under proprietary names.

The powder is obtained by crushing the dried flowers of the pellitory (pyrethrum). The leaves, too, are often used. They are cultivated in the Caucasus, whence the specific name Caucasicum sometimes used. Pyrethrum belongs to the natural order compositæ, and is closely allied to the chrysanthemum. The active principle is not a volatile oil, as stated by some writers, but a rosin, which can be dissolved out from the dry flowers by means of ether. The leaves also contain this rosin but in smaller proportions than the flowers. Tincture of pyrethrum is made by infusing the dried flowers in five times their weight of rectified spirit of wine. Diluted with water it is used as a lotion.

Borax powder also makes a very good insectifuge. It appears to be particularly effective against the common or kitchen cockroach. Camphor is sometimes used, and the powdered dried root of acorus calamus, the sweet flag. A mixture of white lead with four times its weight of chalk is also highly recommended. The fish-oil soaps used in a powdered form are made from various recipes, of which the following is a typical example:

Powdered rosin.....	2 pounds
Caustic soda.....	8 ounces
Fish or whale oil.....	4 ounces

Boil together in a gallon of water for at least an hour, replacing some of the water if required.

The following insect-powder formulas are perfectly safe to use. In each instance insect powder relates to either one of the pyrethrum plants powdered, or to a mixture:

I.—Insect powder....	8 ounces av.
Powdered borax..	8 ounces av.
Oil of pennyroyal.	2 fluidrachms

II.—Insect powder....	8 ounces av.
Borax.....	8 ounces av.
Sulphur.....	4 ounces av.
Oil of eucalyptus.	2 fluidrachms

This formula is especially good for cockroaches:

III.—Insect powder....	14 ounces av.
Quassia in fine powder.....	6 ounces av.
White hellebore, powdered.....	2 ounces av.

Beetle Powder.—

Cocoa powder	4 ounces
Starch	8 ounces
Borax	37 ounces

Mix thoroughly.

Remedies Against Mosquitoes.—A remedy to keep off mosquitoes, etc., is composed as follows: Cinnamon oil, 1 part; patchouli oil, 1 part; sandal oil, 4 parts; alcohol, 400 parts. This has a pleasant odor.

Oil of pennyroyal is commonly used to keep mosquitoes away. Some form of petroleum rubbed on the skin is even more efficient, but unpleasant to use, and if left on long enough will burn the skin.

A 40 per cent solution of formaldehyde for mosquito bites gives remarkably quick and good results. It should be applied to the bites as soon as possible with the cork of the bottle, and allowed to dry on. Diluted ammonia is also used to rub on the bites.

Roach Exterminators.—Borax, starch, and cocoa are said to be the principal ingredients of some of the roach foods on the market. A formula for a poison of this class is as follows:

Borax	37 ounces
Starch	9 ounces
Cocoa	4 ounces

Moth Exterminators.—Cold storage is the most effective means of avoiding the ravages of moths. Where this is impracticable, as in bureau drawers, camphor balls may be scattered about with satisfactory result. The following is also effective:

Spanish pepper	100 parts
Turpentine oil	50 parts
Camphor	25 parts
Clove oil	10 parts
Alcohol, 96 per cent.	900 parts

Cut the Spanish pepper into little bits, and pour over them the alcohol and oil of turpentine. Let stand 2 or 3 days, then decant, and press out. To the liquid thus obtained add the camphor and clove oil, let stand a few days, then filter and fill into suitable bottles. To use, imbibe bits of bibulous paper in the liquid and put them in the folds of clothing to be protected.

Protecting Stuffed Furniture from Moths.—The stuffing, no matter whether consisting of tow, hair, or fiber, as well as the covering, should be coated with a 10 per cent solution of sulphur in carbon sulphide. The carbon sulphide dissolves the sulphur so as to cause a very fine division and to penetrate the fibers completely.

Powder to Keep Moths Away.—

Cloves	2 ounces
Cinnamon	2 ounces
Mace	2 ounces
Black pepper	2 ounces
Orris root	2 ounces

Powder coarsely and mix well together.

Book-Worms.—When these insects infest books they are most difficult to deal with, as the ordinary destructive agents injuriously affect the paper of the book. The books should be well beaten and exposed to the sun, and a rag moistened with formalin passed through the binding and the covers where possible. In other cases the bottom edge of the binding should be moistened with formalin before putting on the shelves, so that formaldehyde vapor can be diffused.

INSECT POWDERS:
See Insecticides.

INSECT TRAP.

Into a china wash-basin, half filled with water, pour a glass of beer; cover the basin with a newspaper, in the center of which a small round hole is cut. Place it so that the edges of the paper lie on the floor and the hole is over the center of the basin. At night beetles and other insects, attracted by the smell of beer, climb the paper and fall through the hole into the liquid.

INSTRUMENT ALLOYS:
See Alloys.

INSTRUMENT CLEANING:
See Cleaning Preparations and Methods.

INSTRUMENT LACQUER:
See Lacquers.

Insulation

ELECTRIC INSULATION:

Insulating Varnishes. — For earth cables and exposed strong current wires:

I.—Melt 2 parts of asphalt together with 0.4 parts of sulphur, add 5 parts of linseed-oil varnish, linseed oil or cotton-seed oil, keep at 320° F. for 6 hours; next pour in oil of turpentine as required.

II.—Maintain 3 parts of elaterite with 2 parts of linseed-oil varnish at 392° F. for 5 to 6 hours; next melt 3 parts of asphalt, pour both substances together, and again maintain the temperature of

392° F. for 3 to 4 hours, and then add 1 part of linseed-oil varnish and oil of turpentine as required.

III.—**Insulating Varnish for Dynamos and Conduits with Low Tension.**—Shellac, 4 parts; sandarac, 2 parts; linoleic acid, 2 parts; alcohol, 15 parts.

IV.—An insulating material which contains no caoutchouc is made by dissolving natural or coal-tar asphalt in wood oil, adding sulphur and vulcanizing at 572° F. The mixture of asphalt and wood oil may also be vulcanized with chloride of sulphur by the ordinary process used for caoutchouc. Before vulcanizing, a solution of rubber scraps in naphthalene is sometimes added and the naphthalene expelled by a current of steam. Substitutes for hard rubber are made of natural or artificial asphalt combined with heavy oil of tar and talc or infusorial earth.

Most of the insulating materials advertised under alluring names consist of asphalt combined with rosin, tar, and an inert powder such as clay or asbestos. Some contain graphite, which is a good conductor and therefore a very undesirable ingredient in an insulator.

INSULATION AGAINST HEAT.

An asbestos jacket is the usual insulator for boilers, steampipes, etc. The thicker the covering around the steampipe, the more heat is retained. A chief requirement for such protective mass is that it contains air in fine channels, so that there is no connection with the closed-in air. Most substances suitable for insulating are such that they can only with difficulty be used for a protective mass. The most ordinary way is to mix infusorial earth, kieselguhr, slag-wool, hair, ground cork, etc., with loam or clay, so that this plastic mass may be applied moist on the pipes. In using such substances care should be taken carefully to clean and heat the surfaces to be covered. The mass for the first coating is made into a paste by gradual addition of water and put on thick with a brush. After drying each time a further coating is applied. This is repeated until the desired thickness is reached. The last layer put on is rubbed smooth with the flat hand. Finally, strips of linen are wound around, which is coated with tar or oil paint as a protection against outside injuries. Cork stones consist of crushed cork with a mineral binding agent, and are sold pressed into various shapes.

Leather Waste Insulation.—Portions of leather, such as the fibers of sole leather of any size and form, are first rendered soft. The surface is then carded or the surface fibers scratched or raised in such a manner that when several pieces are pressed together their surface fibers adhere, and a compact, durable piece of leather is produced. The carding can be done by an ordinary batting machine, the action of which is so regulated that not only are the pieces of leather softened, but the fibers on their surfaces raised. The structure of the separate pieces of leather remains essentially unaltered. The raised fibers give the appearance of a furry substance to the leather. The batted pieces of leather are well mixed with paste or some suitable gum, either in or outside of the machine, and are then put into specially shaped troughs, where they are pressed together into layers of the required size and thickness. The separate pieces of leather adhere and are matted together. An agglutinant, if accessible, will contribute materially to the strength and durability of the product. The layers are dried, rolled, and are then ready for use. The pieces need not be packed together promiscuously. If larger portions of waste can be secured, the separate pieces can be arranged one upon another in rows. The larger pieces can also be used for the top and bottom of a leather pad, the middle portion of which consists of smaller pieces.

INSULATION AGAINST MOISTURE, WEATHER, ETC.

Experiments have shown that with the aid of red lead a very serviceable, resistive, and weatherproof insulation material may be produced from inferior fibers, to take the place, in many cases, of gutta-percha and other substances employed for insulating purposes, and particularly to effect the permanent insulation of aerial conductors exposed to the action of the weather. Hackethal used for the purpose any vegetable fiber which is wrapped around the conductors to be insulated. The fiber is then saturated with liquid red lead. The latter is accomplished in the proportion of 4 to 5 parts of red lead, by weight, to 1 part, by weight, of linseed oil, by the hot or cold process, by mere immersion or under pressure. All the three substances, fiber, oil, and red lead, possess in themselves a certain insulating capacity, but none of them is alone of utility for such purposes. Even the red lead mixed with linseed oil does not possess in the liquid state a high degree of insulating power.

Only when both substances, the ingredients of the linseed oil capable of absorbing oxygen and the lead oxide rich in oxygen, oxidize in the air, a new gummy product of great insulating capacity results.

INTENSIFIERS:
See Photography.

IODINE SOLVENT.

Iodine is quickly dissolved in oils by first rubbing up the iodine with one-fourth of its weight of potassium iodide and a few drops of glycerine, then adding a little oil and rubbing up again. The addition of the resultant liquid to the rest of the oil and a sharp agitation finishes the process.

IODINE SOAP:
See Soap.

IODOFORM DEODORIZER.

Rub the part with about a teaspoonful of wine vinegar, after a previous thorough washing with soap.

Iron

(See also Metals and Steel.)

To Color Iron Blue.—One hundred and forty parts of hyposulphite of soda are dissolved in 1,000 parts of water; 35 parts of acetate of lead are dissolved in 1,000 parts of water; the two solutions are mixed, boiled, and the iron is immersed therein. The metal takes a blue color, such as is obtained by heating.

To Distinguish Iron from Steel.—The piece of metal to be tested is washed and then plunged into a solution of bichromate of potash, with the addition of considerable sulphuric acid. In half a minute or a minute the metal can be taken out, washed, and wiped. Soft steels and cast iron assume under this treatment an ash-gray tint. Tempered steels become almost black, without any metallic reflection. Puddled and refined irons remain nearly white and always have metallic reflections on the part of their surface previously filed, the remainder of the surface presenting irregular blackish spots.

Another method is to apply a magnet. Steel responds much more quickly and actively to the magnetic influence than does iron.

Powder for Hardening Iron and Steel.—For wrought iron place in the charge 20 parts, by weight, of common salt; 2 parts, by weight, of potassium cyanide; 0.3 parts, by weight, of potassium bichromate; 0.15 parts, by weight, of broken glass; and 0.1 part, by weight, of potassium nitrate for case-hardening. For cooling and hardening cast iron: To 60 parts, by weight, of water add 2.5 parts, by weight, of vinegar; 3 parts, by weight, of common salt; and 0.25 parts, by weight, of hydrochloric acid.

Preventing the Peeling of Coatings for Iron.—To obviate the scaling of coatings on iron, if exposed to the attacks of the weather, it is advisable to wash the iron thoroughly and to paint it next with a layer of boiling linseed oil. If thus treated, the paint never cracks off. If the iron objects are small and can be heated, it is advantageous to heat them previously and to dip them into linseed oil. The boiling oil enters all the pores of the metal and drives out the moisture. The coating adheres so firmly that frost, rain, nor wind can injure it.

To Soften Iron Castings.—To soften hard iron castings, heat the object to a high temperature, cover it over with fine coal dust or some similar substance, and allow it to cool gradually. When the articles are of small size, a number of them are packed in a crucible with substances yielding carbon to iron at a glowing heat. The crucible is then tightly closed, and placed in a stove or on an open fire. It is gradually heated and kept at a red heat for several hours, and then allowed to cool slowly. Cast-iron turnings, carbonate of soda, and unrefined sugar are recommended as substances suitable for packing in the crucible with the castings. If unrefined sugar alone is added, the quantity must not be too small. By this process the iron may be rendered extremely soft.

To Whiten Iron.—Mix ammoniacal salt in powder with an equal volume of mercury. This is dissolved in cold water and mixed thoroughly. Immerse the metal, heated to redness, in this bath and it will come out possessing the whiteness and beauty of silver. Care should be taken not to overheat the article and thus burn it.

Iron to Nickelplate by Friction.—In nickelplating iron, a thin coating of copper can first be produced on it by rubbing on a solution of 20 parts of sulphate of copper, 5 parts of sulphuric acid and 100 parts of water. After the copper plate has been formed rub over it, with a rag, a solution of 3 parts tin, 6 parts nickel and 1 part iron in 100 parts of hydrochloric acid and 3 parts of sulphuric

acid. If finally the object is rubbed with a rag that has been dipped in finely pulverized zinc, a nickel deposit will be made on the copper. The thickness of the nickel deposit can be increased by repeating the two last operations. A silver coating can be produced by dissolving freshly precipitated chloride of silver in a solution of hyposulphite of soda, 1.1 parts to 10 parts of water, and adding to this solution 180 parts spirits of sal ammoniac and then stirring in 800 parts of finely washed chalk. This mixture is applied and rubbed until it dries on the object being silvered, and the result is a brilliant deposit of pure silver.

Ivory

(See also Bones, Shell, and Horn.)

TO COLOR IVORY:

Red.—The article is placed for 24 hours in water, 1,000 parts of which carry 100 parts of vinegar (acetic acid, 6 per cent), and from 1 to 5 parts of aniline red. As soon as it acquires the desired color pour off the liquid, let the ivory dry, and polish with Vienna lime.

Black.—Wash the article first in potash or soda lye and then put into a neutral solution of silver nitrate. Drain off the liquid and lay in the direct sunshine.

Red-Purple.—Put the article in a weak solution of triple gold chloride and then into direct sunshine.

Red.—For a different shade of red (from the first given), place the article for a short time in water weakly acidified with nitric acid and then in a solution of cochineal in ammonia.

Yellow.—Leave for several hours in a solution of lead acetate, rinse and dry. When quite dry place in a solution of potassium chromate.

To Color Billiard Balls Red.—

Fiery Red.—Wash the article first in a solution of carbonate of soda, then plunge for a few seconds in a bath of equal parts of water and nitric acid. Remove, rinse in running water; then put in an alcoholic solution of fuchsine and let it remain until it is the required color.

Cherry Red.—Clean by washing in the sodium carbonate solution, rinse and lay in a 2 per cent solution of tin chloride, for a few moments, then boil in a solution of logwood. Finally lay in a solution of potassium carbonate until it assumes the desired color.

Pale Red.—Wash in soda solution, rinse and lay for 25 minutes in a 5 per cent solution of nitric acid, rinse, then lay for several minutes in a weak solution of tin chloride. Finally boil in the following solution: Carmine, 2 parts; sodium carbonate, 12 parts; water, 200 parts; acetic acid enough to saturate.

Brown.—Apply several coats of an ammoniacal solution of potassium permanganate. Similar results are obtained if the solution is diluted with vinegar, and the ivory article allowed to remain in the liquid for some time.

Etching on Ivory (see also Etching).—Although decorations on ivory articles, such as umbrella handles, cuff-buttons, fans, book-covers, boxes, etc., are generally engraved, the work is frequently done by etching. The patterns must be very delicate, and are executed in lines only. The simplest way is to cover the surface with a thin rosin varnish. Then transfer the pattern and scratch it out accurately with a pointed needle. Otherwise proceed same as in etching on metal and stone, making an edge of modeling wax around the surface to be etched and pouring on the acid, which consists, in this case, of sulphuric acid, 1 part, to which 5 to 6 parts of water are added. It acts very quickly. The lines turn a deep black. If brown lines are desired, dissolve 1 part of silver nitrate in 5 parts of water, etch for a short time, and expose the article for a few hours to the light, until the design turns brown. Very often etchings in ivory are gilded. For this purpose, fill the etched patterns accurately with siccatives, using a writing pen, dry, and dab on gold leaf. After a few hours remove the superfluous gold with wadding, and the design will be nicely gilded. Etched ivory articles present a very handsome appearance if they are first covered with a silvery gloss, the design being gilded afterwards. For the former purpose the etched object is laid in the above described solution of silver nitrate until it has acquired a dark yellow color. Then rinse it off in clean water and, while still moist, expose to direct sunlight. After 3 to 4 hours the surface becomes entirely black, but will take on a fine silvery luster if rubbed with soft leather.

Flexible Ivory.—To soften ivory and render it flexible put pure phosphoric acid (specific gravity, 1.13) into a wide-mouthed bottle or jar that can be covered, and steep the ivory in this until it partially loses its opacity; then wash the ivory in cold, soft water and dry, when the ivory will be found soft and flexible.

It regains its hardness in course of time when freely exposed to air, although its flexibility can be restored by immersing the ivory in hot water.

Another softening fluid is prepared by mixing 1 ounce of spirit of niter with 5 ounces of water and steeping the ivory in the fluid for 4 or 5 days.

Hardened Ivory.—To restore the hardness to ivory that has been softened by the above methods, wrap it in a sheet of white writing paper, cover it with dry decrepitated salt, and let it remain thus covered for 24 hours. The decrepitated salt is prepared by strewing common kitchen salt on a plate or dish and standing same before a fierce fire, when the salt loses its crystalline appearance and assumes a dense opaque whiteness.

IMITATION IVORY:

See also Casein and Plaster.

Manufacture of Compounds Imitating Ivory, Shell, etc.—Casein, as known, may act the part of an acid and combine with bases to form caseinates or caseates; among these compounds, caseinates of potash, of soda, and of ammonia are the only ones soluble in water; all the others are insoluble and may be readily prepared by double decomposition. Thus, for example, to obtain caseinate of alumina, it is sufficient to add to a solution of casein in caustic soda a solution of sulphate of alumina; an insoluble precipitate of casein, or caseinate of alumina, is instantly formed. This precipitate ought to be freed from the sulphate of soda (formed by double decomposition) by means of prolonged washing.

When pure, ordinary cellulose may be incorporated with it by this process, producing a new compound, cheaper than pure cellulose, although possessing the same properties, and capable of replacing it in all its applications. According to the results desired, in transparency, color, hardness, etc., the most suitable caseinate should be selected. Thus, if a translucent compound is to be obtained, the caseinate of alumina yields the best. If a white compound is desired, the caseinate of zinc or of magnesia should be chosen; and for colored products the caseinates of iron, copper, and nickel will give varied tints.

The process employed for the new products, with a base of celluloid and caseinate, is as follows: On one hand casein is dissolved in a solution of caustic soda (100 of water for 10 to 25 of soda), and this liquid is filtered, to separate the matters not dissolved and the impurities.

On the other hand, a salt (of the base of which the caseinate is desired) is dissolved, and the solution filtered. It is well not to operate on too concentrated a solution. The two solutions are mixed in a reservoir furnished with a mechanical stirrer, in order to obtain the insoluble caseinate precipitate in as finely divided a state as possible. This precipitate should be washed thoroughly so as to free it from the soda salt formed by double decomposition, but on account of its gummy or pasty state, this washing presents certain difficulties, and should be done carefully. After the washing it should be freed from the greater part of water contained by draining, followed by drying, or energetic pressing; then it is washed in alcohol, dried or pressed again, and is ready to be incorporated in the mass of the celluloid.

For the latter immersion and washing, it has been found that an addition of 1 to 5 per cent of borax is advantageous, for it renders the mass more plastic, and facilitates the operation of mixing. This may be conducted in a mixing apparatus; but, in practice, it is found preferable to effect it with a rolling mill, operated as follows:

The nitro-cellulose is introduced in the plastic state, and moistened with a solution of camphor in alcohol (40 to 50 parts of camphor in 50 to 70 parts of alcohol for 100 parts of nitro-cellulose) as it is practiced in celluloid factories.

This plastic mass of nitro-cellulose is placed in a rolling mill, the cylinders of which are slightly heated at the same time as the caseinate, prepared as above; then the whole mass is worked by the cylinders until the mixture of the two is perfectly homogeneous, and the final mass is sufficiently hard to be drawn out in leaves in the same way as practiced for pure celluloid. These leaves are placed in hydraulic presses, where they are compressed, first hot, then cold, and the block thus formed is afterwards cut into leaves of the thickness desired. These leaves are dried in an apparatus in the same way as ordinary celluloid. The product resembles celluloid, and has all its properties. At 195° to 215° F. it becomes quite plastic, and is easily molded. It may be sawed, filed, turned, and carved without difficulty, and takes on a superb polish. It burns less readily than celluloid, and its combustibility diminishes in proportion as the percentage of caseinate increases; finally, the cost price is less than that of celluloid,

and by using a large proportion of caseinate, products may be manufactured at an extremely low cost.

IVORY AND BONE BLEACHES.

If simply dirty, scrub with soap and tepid water, using an old tooth or nail brush for the purpose. Grease stains may be sometimes removed by applying a paste of chalk or whiting and benzol, covering the article so that the benzol may not dry too rapidly. Carbon disulphide (the purified article) may be used in place of benzol. When dry, rub off with a stiff brush. If not removed with the first application, repeat the process. Delicately carved articles that show a tendency to brittleness should be soaked for a short time in dilute phosphoric acid before any attempt to clean them is made. This renders the minuter portions almost ductile, and prevents their breaking under cleaning.

The large scratched brush should be treated as follows: If the scratches are deep, the surface may be carefully rubbed down to the depth of the scratch, using the finest emery cloth, until the depth is nearly reached, then substituting crocus cloth.

To restore the polish nothing is superior to the genuine German putz pomade, following by rubbing first with chamois and finishing off with soft old silk. The more "elbow grease" put into the rubbing the easier the task, as the heat generated by friction seems to lend a sort of ductility to the surface. To remove the yellow hue due to age, proceed as follows: Make a little tripod with wire, to hold the object a few inches above a little vessel containing lime chloride moistened with hydrochloric acid; put the object on the stand, cover the whole with a bell glass, and expose to direct sunlight. When bleached, remove and wash in a solution of sodium bicarbonate, rinse in clear water and dry.

Like mother-of-pearl, ivory is readily cleaned by dipping in a bath of oxygenized water or immersing for 15 minutes in spirits of turpentine, and subsequently exposing to the sun for 3 or 4 days. For a simple cleaning of smooth articles, wash them in hot water, in which there has been previously dissolved 100 parts (by weight) of bicarbonate of soda per 1,000 parts of water. To clean carved ivory make a paste of very fine, damp sawdust, and put on this the juice of 1 or 2 lemons, according to the article to be treated. Now apply a layer of this sawdust on the ivory, and when dry brush it off and rub the object with a chamois.

IVORY TESTS.

Many years ago an article was introduced in the industrial world which in contradistinction to the genuine animal ivory, has its origin in the vegetable kingdom, being derived from the nut of a palm-like shrub called phytelephasmacrocarpa, whose fruit reaches the size of an apple. This fruit has a very white, exceedingly hard kernel which can be worked like ivory. A hundred of these fruits only costing about $1, their use offers great advantages. Worked on the lathe this ivory can be passed off as the genuine article, it being so much like it that it is often sold at the same price. It can also be colored just like genuine ivory.

To distinguish the two varieties of ivory, the following method may be employed: Concentrated sulphuric acid applied to vegetable ivory will cause a pink coloring in about 10 or 12 minutes, which can be removed again by washing with water. Applied on genuine ivory, this acid does not affect it in any manner.

IVORY BLACK:
See Bone Black.

IVORY CEMENT:
See Adhesives.

IVORY GILDING:
See Plating.

IVORY POLISHES:
See Polishes.

JAPAN BLACK:
See Paints.

JAPANNING AND JAPAN TINNING:
See Varnishes.

JASMINE MILK:
See Cosmetics.

JELLY (FRUIT) EXTRACT:
See Essences and Extracts.

JEWELERS' CEMENTS:
See Adhesives.

JEWELERS' CLEANING PROCESSES:
See Cleaning Preparations and Methods.

Jewelers' Formulas

(See also Gems, Gold, and Watchmakers' Recipes.)

Coloring Gold Jewelry.—Following are several recipes for coloring: Saltpeter, 40 parts; alum, 30 parts; sea salt, 30 parts; or, liquid ammonia, 100 parts; sea salt, 3 parts; water, 100 parts. Heat without allowing to boil and plunge

the objects into it for 2 or 3 minutes, stirring constantly; rinse in alum water and then in clean water. Another recipe: Calcium bromide, 100 parts; bromine, 5 parts. Place the articles in this solution, with stirring, for 2 to 3 minutes; next wash in a solution of hyposulphite of sodium and rinse in clean water. Another: Verdigris, 30 parts; sea salt, 30 parts; blood stone, 30 parts; sal ammoniac, 30 parts; alum, 5 parts. Grind all and stir with strong vinegar; or, verdigris, 100 parts; hydrochlorate of ammonia, 100 parts; saltpeter, 65 parts; copper filings, 40 parts. Bray all and mix with strong vinegar.

To Widen a Jewel Hole.—Chuck the hole in a lathe with cement. Place a spirit lamp underneath to prevent the cement from hardening. Hold the pointed bit against the hole, while the lathe is running, until the hole is true, when the lamp should be removed. The broach to widen the hole should be made of copper, of the required size and shape, and the point, after being oiled, should be rolled in diamond dust until it is entirely covered. The diamond dust should then be beaten in with a burnisher, using very light blows so as not to bruise the broach. After the hole is widened as desired, it requires polishing with a broach made of ivory and used with oil and the finest diamond dust, loose, not driven into the broach.

To Clean Jet Jewelry.—Reduce bread crumbs into small particles, and introduce into all the curves and hollows of the jewelry, while rubbing with a flannel.

Coloring Common Gold.—In coloring gold below 18 carat, the following mixture may be used with success, and if carefully employed, even 12 carat gold may be colored by it: Take nitrate of potassa (saltpeter), 4 parts, by weight; alum, 2 parts; and common salt, 2 parts. Add sufficient warm water to mix the ingredients into a thin paste; place the mixture in a small pipkin or crucible and allow to boil. The article to be colored should be suspended by a wire and dipped into the mixture, where it should remain from 10 to 20 minutes. The article should then be removed and well rinsed in hot water, when it must be scratch brushed, again rinsed and returned to the coloring salts for a few minutes; it is then to be again rinsed in hot water, scratch brushed, and finally brushed with soap and hot water, rinsed in hot water, and placed in boxwood sawdust. The object being merely to remove the alloy, as soon as the article has acquired the proper color of fine gold it may be considered sufficiently acted upon by the above mixture. The coloring salts should not be used for gold of a lower standard than 12 carat, and, even for this quality of gold, some care must be taken when the articles are of a very slight make.

Shades of Red, etc., on Matt Gold Bijouterie.—For the production of the red and other shades on matt gold articles, the so-called gold varnishes are employed, which consist of shellac dissolved in alcohol and are colored with gum rosins. Thus a handsome golden yellow is obtained from shellac, 35 parts; seed-lac, 35 parts; dragon's blood, 50 parts; gamboge, 50 parts; dissolved in 400 parts of alcohol; the clear solution is decanted and mixed with 75 parts of Venice turpentine. By changing the amounts of the coloring rosins, shades from bright gold yellow to copper color are obtained. The varnish is applied evenly and after drying is wiped off from the raised portions of the article by means of a pad of wadding dipped into alcohol, whereby a handsome patination effect is produced, since the lacquer remains in the cavities. Chased articles are simply rubbed with earth colors ground into a paste with turpentine oil, for which purpose burnt sienna, fine ochers of a golden color, golden yellow, and various shades of green are employed.

I.—	Yellow wax	32 parts
	Red bole	3 parts
	Crystallized verdigris	2 parts
	Alum	2 parts
II.—	Yellow wax	95 parts
	Red bole	64 parts
	Colcothar	2 parts
	Crystallized verdigris	32 parts
	Copper ashes	20 parts
	Zinc vitriol	32 parts
	Green vitriol	16 parts
	Borax	1 part

The wax is melted and the finely powdered chemicals are stirred in, in rotation. If the gilt bronze goods are to obtain a lustrous orange shade, apply a mixture of ferric oxide, alum, cooking salt, and vinegar in the heated articles by means of a brush, heating to about 266° F. until the shade commences to turn black and water sprinkled on will evaporate with a hissing sound, then cool in water, dip in a mixture of 1 part of nitric acid with 40 parts of water, rinse

thoroughly, dry, and polish. For the production of a pale-gold shade use a wax preparation consisting of:

III.—Yellow wax	19 parts
Zinc vitriol	10 parts
Burnt borax	3 parts

Green-gold color is produced by a mixture of:

IV.—Saltpeter	6 parts
Green vitriol	2 parts
Zinc vitriol	1 part
Alum	1 part

To Matt Gilt Articles.—If it is desired to matt gilt articles partly or entirely, the portions which are to remain burnished are covered with a mixture of chalk, sugar, and mucilage, heating until this "stopping-off" covering shows a black color. On the places not covered apply a matting powder consisting of:

Saltpeter	40 parts
Alum	25 parts
Cooking salt	35 parts

Heat the objects to about 608° F., whereby the powder is melted and acquires the consistency of a thin paste. In case of too high a temperature decomposition will set in.

To Find the Number of Carats.—To find the number of carats of gold in an object, first weigh the gold and mix with seven times its weight in silver. This alloy is beaten into thin leaves, and nitric acid is added; this dissolves the silver and copper. The remainder (gold) is then fused and weighed; by comparing the first and last weights the number of carats of pure gold is found. To check repeat several times.

Acid Test for Gold.—The ordinary ready method of ascertaining whether a piece of jewelry is made of gold consists in touching it with a glass stopper wetted with nitric acid, which leaves gold untouched, but colors base alloys blue from the formation of nitrate of copper.

Imitation Diamonds.—I.—Minium, 75 parts (by weight); washed white sand, 50 parts; calcined potash, 18 parts; calcined borax, 6 parts; bioxide of arsenic, 1 part. The sand must be washed in hydrochloric acid and then several times in clean water. The specific gravity of this crystal glass is almost the same as that of the diamond.

II.—Washed white sand, 100 parts (by weight); minium, 35 parts; calcined potash, 25 parts; calcined borax, 20 parts; nitrate of potash (crystals), 10 parts; peroxide of manganese, 5 parts. The sand must be washed as above stated.

Diamantine.—This substance consists of crystallized boron, the basis of borax. By melting 100 parts of boracic acid and 80 parts of aluminum crystals is obtained the so-called bort, which even attacks diamond. The diamantine of commerce is not so hard.

To Refine Board Sweepings.—The residue resulting from a jobbing jeweler's business, such as board sweepings and other residuum, which is continually accumulating and which invariably consists of all mixed qualities of standard, may have the precious metals recovered therefrom in a very simple manner, as follows: Collect the residue and burn it in an iron ladle or pan, until all grease or other organic matter is destroyed. When cool mix with ½ part soda-ash, and melt in a clay crucible. When the metal is thoroughly melted it will leave the flux and sink to the bottom of the crucible; at this stage the flux assumes the appearance of a thin fluid, and then is the time to withdraw the pot from the fire. The metal in the crucible—but not the flux—may now be poured into a vessel of water, stirring the water in a circular direction while the metal is being poured in, which causes it to form into small grains, and so prepares it for the next process. Dissolve the grains in a mixture of nitric acid and water in equal quantities. It takes about four times the quantity of liquid as metal to dissolve. The gold remains undissolved in this mixture, and may be recovered by filtering or decanting the liquid above it in the dissolving vessel; it is then dried, mixed with a little flux, and melted in the usual manner, whereupon pure gold will be obtained. To recover the silver, dilute the solution which has been withdrawn from the gold with six times its bulk of water, and add by degrees small quantities of finely powdered common salt, and this will throw down the silver into a white, curdy powder of chloride of silver. Continue to add salt until no cloudiness is observed in the solution, when the water above the sediment may be poured off; the sediment is next well washed with warm water several times, then dried and melted in the same manner as the gold, and you will have a lump of pure silver.

Restoration of the Color of Turquoises.—After a certain time turquoises lose a part of their fine color. It is easy to restore the color by immersing them in a solution of carbonate of soda. But it seems that the blue cannot be restored anew after this operation, if it again becomes dull. The above applies to